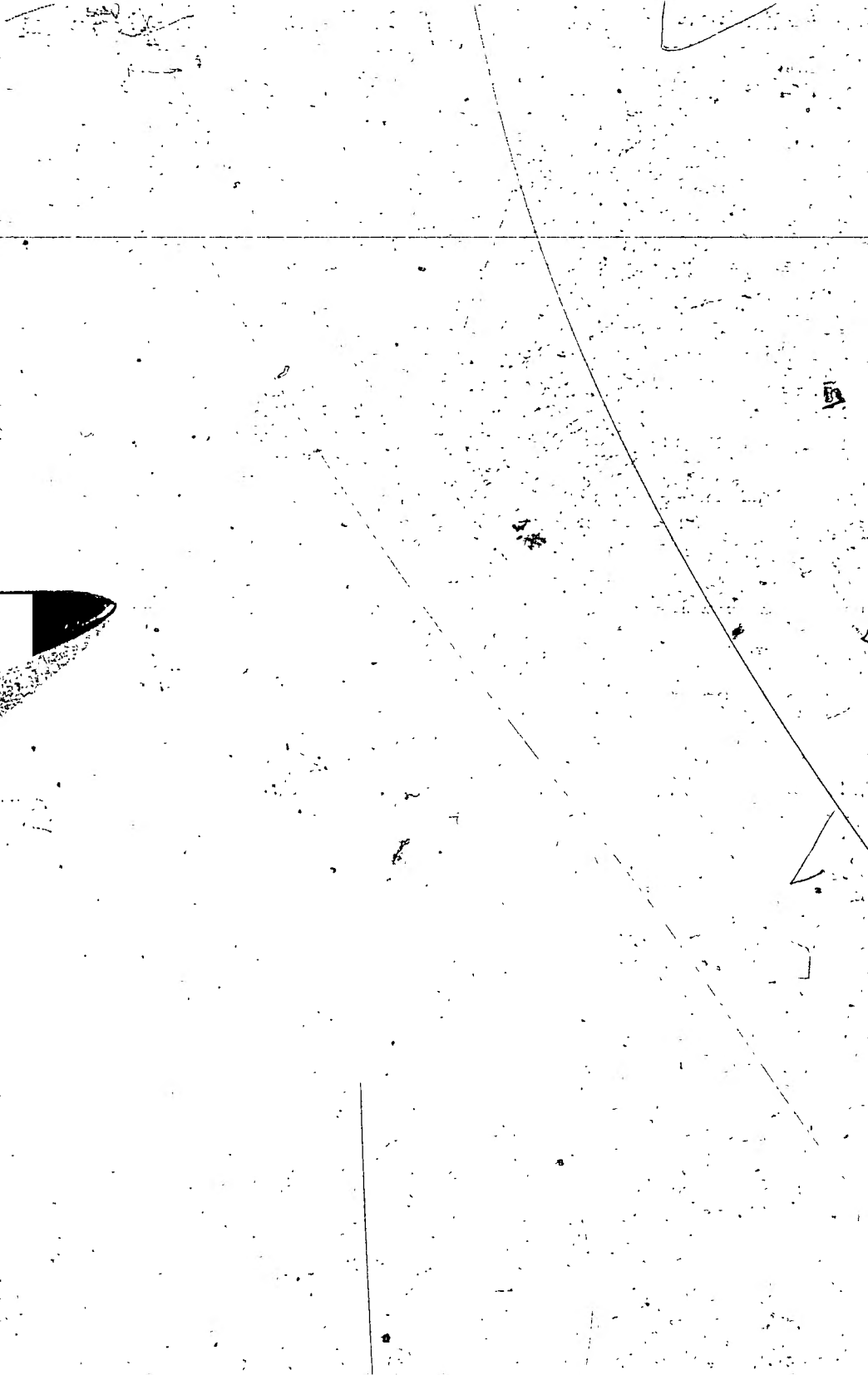
THE UNIVERSITY OF ALBERTA

1908 - 1933



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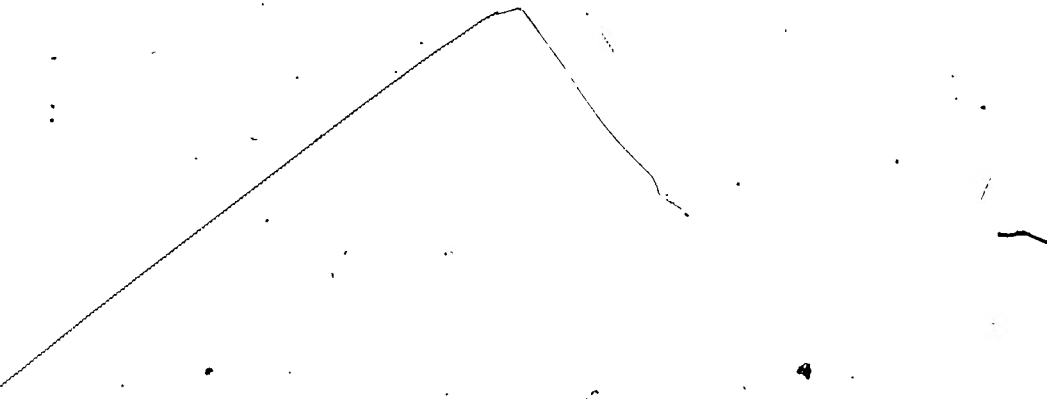

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"It is a place where inquiry is pushed forward, and discoveries verified and perfected, and rashness rendered innocuous, and error exposed, by the collision of mind with mind, and knowledge with knowledge."

J. H. Newman: The Idea of a University.

Retrospect

On May 16th of this year (1933) at the annual Convocation, twenty-five years of academic work of the University of Alberta will have been completed. At the close of a quarter of a century it is fitting to look back, to evaluate what has been done, and to lay plans for the future. In the following pages an account is given of some of the contributions which the University has made during the past twenty-five years in teaching, public service, and research. It is not a complete picture. The personal reference has been omitted. The things that will endure are the values that have been created. It is on these values that the emphasis has been placed in this estimate of the University of Alberta in the first twenty-five years of its history.

A quarter of a century is a sufficiently long period to be significant. The last quarter of a century is of peculiar significance. From a world standpoint, the Great War and its aftermath will mark this period as one which will stand out in history as destructive of idealism and constructive in social planning. The repercussion on university life and thought has been fundamental. Not for generations have students addressed themselves to the study of the political and economic structure of world society as they have been doing in the past few years. And the mood has not been that of high hope and enthusiasm, as has characterized some of the student movements in the past. It has been realistic and practical in temper, born of the feeling that all is not well, and that no structure is sacred and protected from analysis. It is not to be wondered at that the young men and women who suffer most severely from the incidence of economic depressions should concern themselves with its causes and its possible remedies. They have been facing conditions very different from those which confronted the students in the universities who met the demands of the war with such high courage and devotion. They may be expected to show a similar regardlessness of self in their approach to the problems of their own age.

The pioneering stage

There is another aspect of the last twenty-five years which gives it special significance in a western Canadian setting. It represents the period of the most intensive pioneering activity. While the stage had already been set and the groundwork had been laid, the great influx of population took place within the period under review. The settling of the Canadian West is one of the important pioneering episodes in history. It is the only one which has yet been carefully studied in its scientific, economic, and

sociological aspects. It has been a period of amazing material progress, and of far-reaching economic and social experiments. Men and women were intensely concerned with the practical things of life, for there was much to accomplish, if conditions of living were to be reasonably secure. It was in this atmosphere that the western universities took their being, and carried on. It is of particular interest to analyse the contribution that has been made by them under such conditions.

There was a background for the rapid development of facilities for higher education in western Canada in the past quarter of a century. The settling of the Red River Valley, reaching back in time almost a century before the opening of the period under review, led to the provision for educational facilities in the form of church schools, and, eventually, church colleges. The act of 1877 established the University of Manitoba as an examining and degree conferring institution, combining four denominational colleges into the one body for these purposes, and making provision for the right to teach independent of these colleges. The development of a teaching faculty outside of the jurisdiction of the colleges took place only in 1904, which date may be taken as the time of the beginning of university education in the west in its present form. In British Columbia as well, a denominational college, with affiliations with McGill University, preceded the establishment of the University of British Columbia. In Saskatchewan and Alberta the universities were formed independently of any educational institutions in these provinces, and without affiliations. It was thus possible to plan without consideration of commitments or obligations already incurred, and with complete freedom of action. Against this advantage there has to be set the definite disadvantage that there had not been established before the universities were inaugurated a loyalty to higher education through sacrifice, such as had been the tradition of denominational college education in the Red River Valley over many years.

Beginnings in Alberta

The newly established province saw to the needs of higher education. At the first session of the legislature (1906) an act to establish the University was passed. The University opened its doors on September 23rd, 1908. In 1910 the act was revised and provision was made for the setting up of a Board of Governors to administer the financial responsibilities of the University, and for the placing of the definite charge of the academic work on the Senate, a body which up

to that time had had complete responsibility for the University as a whole. With minor modifications, the University has continued under this system of administration, which is now the generally accepted system of university control in Canada, and which needs only the safeguard of a close linkage between the two responsible bodies to be effective in practice. That linkage is secured in the University of Alberta Act by the provision that the Chancellor, the Chairman of the Board of Governors and the President be members of both bodies.

In this retrospect we are concerned with the inner motives which expressed themselves in educational policies over a period of years rather than with individuals. It should be stated in this place, however, that for the first twenty years of pioneering history in the University the President, Dr. H. M. Tory, by his enthusiasm, energy, and far-sighted planning was instrumental in developing, in a short period of years, an institution which took its place proudly among the important seats of higher learning in Canada. The remaining years of the quarter century have carried with them problems of a different kind, and it has fallen to the lot of his successor through the force of economic conditions to evaluate carefully the work which this University, with other universities, carries on, in order that the things which endure should be continued without flagging and in order that the conviction of the value of these things be firmly established in public consciousness. It is with this in mind that the retrospect of the quarter century in this University has been undertaken by a committee of the faculties of the University.

The province in which the University was established has a wide variety of natural resources, the development of which calls for knowledge, technical skill, and scientific investigation. It was to be expected therefore that the new university would equip itself to play its own part in this necessary work in the province from which it was to draw its support. This it has done. The faculty of applied science has kept in mind the needs of professional training in mining and chemical engineering, as well as in civil and electrical engineering. The faculty of agriculture has carried on fundamental research in the problems which face the western farmer. The chemists have dealt with the utilisation of waste gas, the Research Council of Alberta, in close affiliation with the University, with the utilisation of coal and the tarsands. The geologists have mapped the coal-

bearing formations. The institution has applied itself in a very special way to assist, through scientific investigation and the training of students, in the sane development of the natural resources of the province. Much of practical value has been accomplished. We may in retrospect legitimately ask ourselves the question whether this aspect of the work has given the University too practical and too technical a bent.

The sound balance

The safety of a modern university depends on its sound balance between the humanistic and purely scientific studies, on the one hand, and the professional and applied studies, on the other. It can no longer be the aim to develop the former to the exclusion of the latter: while with the preponderance of the latter the university degenerates into a trade school. To keep the balance is the problem for all modern educational institutions. Many of the students who come up to the University are looking for quick, readymade solutions to the difficulties which face the world. It is only by a steady insistence on the need of a thorough background of training in the humanities and the sciences, on which ultimate solutions must be based, that the attitude gradually changes. The insistence is only possible if these subjects are ably represented in the University. From the beginning the strength of these departments has been the particular responsibility of the University: and those who know the University will realise that there has at no time been the danger that the inner culture, which the departments that represent pure knowledge and appreciation are in an especial degree responsible for, be displaced from its rightful position as the first consideration of the University.

For, in retrospect, that is the consideration which matters most. The temper of pioneering is practical, and pioneering demands on every hand practical solutions to the issues which arise. There has been given assistance from the University in its own field in ample measure. But the University has done a much greater thing. It has insisted on the paramount importance of truth for its own sake, of those values in life which literature, philosophy and history reveal, of the zest and enthusiasm which the pursuit of knowledge can give to life, of the long distance views which a study of the background of the history of man cannot fail to impart to the student. In short, the University contributes balance and judgment and a sense of right value. This it has done at a time when material progress was unusually rapid. That has been its outstanding contribution,

and that because of its insistence on placing the cultural influences first in university life. It is a cumulative contribution, for the graduates who have caught the spirit in their student days carry something of the viewpoint through life, and create in their own circle an appreciation of the things which they appreciate.

The professional schools

A question of policy which had early to be decided was the extent to which the professional fields should be cultivated. In this matter the University of Alberta took the position that it should as far as possible give the opportunities to the men and women who desired to equip themselves for professional life. There have been built up, over this period of years, around the central faculty of arts and sciences, faculties of applied science, agriculture, law, medicine, and schools of household economics, commerce, dentistry, nursing, pharmacy and education. The University is broad-based, and attracts to the faculties and schools students from other provinces where facilities in one or other of these fields of training may not be available. The professional schools are closely related to arts and sciences, and the fundamental subjects in arts and science are studied as such, and not in their professional bearing. In law and in medicine in particular, students are in greater and greater numbers taking the combined course, which includes an arts degree as well as the professional degree. In commerce the course is based on the curriculum for the degree in arts, with certain modifications which are essential as a necessary background for commercial work, but which are not sufficiently important to give a professional flavour to the school. The professional schools consciously endeavour to push their roots deep down into the soil of the arts and sciences in order that they may draw on the nourishment which will enrich their whole being. Speaking generally, it would be in the best interests of the University and of the profession if an arts course preceded the professional course: but this is too heavy a demand to make on the time of the average student.

There is a danger in the development of professional schools, here and elsewhere, which is seriously before us. The professions, with the increase of knowledge, are making increasing demands on technique and skill, which in turn demand more of the time of the student in the undergraduate years of his professional training. The training in technique and skill should be a very subsidiary part of the work of a university. Life provides the best opportunity for the ac-

quiring of such abilities. The University on the other hand is the only place where the fundamental background against which the whole body of practice of the professions rests may be obtained. In recent years there has been an increasing tendency, to our mind very significant for the future, to insist on a year or more of interneship in hospitals after graduation in medicine and before entering upon private practice. What is becoming a practice in medicine will probably soon become a practice in all the professions. Much of the technique will be learned in an apprenticeship period after graduation, and the pregraduation course will concern itself with the subjects which have absolutely full right within the University because of their adherence to fundamental principles. In other fields than medicine, the apprenticeship system is in partial operation: in law, pharmacy, dietetics (household economics) and accounting it is already in practice to a varying extent. It is a wilful shutting of the eyes to the facts of present day civilization to say that a university should not concern itself with training for the increasing number of professional vocations. It is all the more imperative, however, that the University in so doing, should remain a university in its real sense.

Coordination in the western universities

The professional schools were established when financial conditions were fairly prosperous, and when progress in development and in settlement was rapid. In these later times of depression through which the country is passing, much concern has been voiced that the western universities should have so far extended their activities in the field of professional training that they might be open to the charge of overlapping, and of duplication which coordination might have avoided. It may be well, in this retrospect, to examine this criticism in some detail.

The central faculty of arts and sciences is necessary in any university. Without it, there is no university. It has been, and is, the heart of each of the western universities. The demands of western pioneering, distinctive in the different provinces, called for applied science and for agriculture. In none of the universities can facilities be provided adequate to meet the demands of the steadily increasing stream of young men who desire to be trained in applied science. Each of the universities has stressed particular aspects of applied science which are of special value in their own constituency. There has been no overlapping, and there has been a more economical administration than would have been possible under a single plan. The faculty of applied

science in each university is more nearly self-sustaining than is any other faculty in the University. The position of agriculture is a different one. The University wisely decided that scientific and technical research in agriculture should be fostered to the fullest possible extent. The future of the West depended primarily on the sound utilization of the soil, the developing of strains both in crops and in domestic animals suitable to the climatic conditions, and the continuous fight against disease. The number of students is relatively small, but the work which the college of agriculture has done in this, as in the other universities, is fundamental in the guiding and assisting of the industry on which the economic stability of the West depends. Without this faculty the University would lack a contact which relates the institution in the most real way to the life of the people. Here too the universities in the West have each specialised in the fields in which they have special demands—the University of Alberta in field crops, animal husbandry and soils.

In medicine the Rockefeller Foundation has assisted the University of Manitoba and the University of Alberta to the extent of $500,000 for each institution, as an aid towards the providing of medical education. This was done after a survey was made of the western situation. The close relationship of the University to the University Hospital, a closed hospital mannd by the clinical staff of the faculty of medicine, provides an opportunity for training which is unusual. The training of the nurses in the hospital is enriched as well by the relationship to the University, where much of the theoretical work is given. All the medical schools in Canada have more applications than their facilities provide. Consolidation could only take place at the cost of very considerable capital expenditure.

As in all the larger faculties so in the smaller faculties and schools, a close relationship is gradually built up between the University and the professions in the province. Such is the case, for instance, in law, pharmacy, education and dentistry. The cost of the smaller schools is very slight, and the great advantage to both profession and school more than outweighs the cost. The medical men of the province, for instance, come to the University and to the hospital clinics for a "refresher" week: and the newer methods are immediately translated into practice through the agency of the University. Such relationships grow as increasing numbers of the graduates of the University go

out into the professions. It is very doubtful if a central school in any of the professional fields, developed at considerable cost, would attract students to any great extent across the provincial boundary lines.

In looking back over the history of the development of the University, aspects of the story have been raised which have created the problems with which the University is faced, in times of severe financial stringency, at the end of the period. They have been raisd in order to view them in the light of the situation of the present day. There has been the continuous striving to develop and to round out an institution worthy of the responsibilities which it has to carry, and of the demands which the people of the province have made on the University. There has been the fixed determination as well that there be only one institution of higher learning in the province. The wisdom of that decision is clearly seen today. That the work of the first two years in arts and sciences may be more widely distributed in junior colleges independent of state support is a question which will be left to the future to canvass. The first two years of arts and sciences work is college work, and may be ultimately carried outside of the University. The afiliation with Mount Royal College is a step in that direction. The later years of the pass degree, the honours work, and the professional work belong to the University, and to the University alone, and cannot be done elsewhere. The University of Alberta in building up these fields of work over the past twenty-five years, is in a strong position to meet the needs of the future of this province. It canot afford to make sacrifices in what has been achieved.

Growth in student body

This is not the place for statistical information. It will, however, round out the mental picture of the changes which the passage of time has brought with it to state that 42 students were in attendance at the session of 1908-09, and 1,965 in the year July, 1932, to May, 1933: that at the Convocation ceremonies of 1911, 8 degrees were granted—2 degrees of B.A., 1 of B.Sc. in Arts, 2 of M.A., and 3 of M.Sc. in Arts: at the Convocation ceremonies of 1932, 266 degrees and 57 diplomas were granted as follows: 90 degrees of B.A., 37 of B.Sc. in Arts, 5 of B.A. (ad eundem), 7 of B.Com., 17 of B.Sc. in Household Economics, 1 of B.H.Ec., 2 of B.Sc. in Pharmacy, 1 of B.Sc. in Architecture, 6 of B.Sc. in Chemical Engineering, 4 of B.Sc. in Civil Engineering, 8 of B.Sc. in Electrical Engineering, 6 of B.Sc. in Mining Engineering, 15 of B.Sc. in Agriculture, 11 of LL.B., 22 of M.D., 7 of

D.D.S., 9 of M.A., 14 of M.Sc., 1 of LL.D. (honoris causa), and 27 diplomas in Nursing, 10 in Pharmacy and high school teachers' certificates. It is an impressive picture.

Extension work

There is a phase of the work of the University to which fuller reference will later be made, but which deserves a place in a discussion of the policies which have been effective in the building up of the University. To a rather unusual degree the University has maintained a relationship to the people of the province as a whole through an extension service, connected not merely with the practical, but with the cultural emphasis in life. There have been used the agencies of the lecture, the lantern slide and film, the travelling library and the open book shelf, the debate and the supplying of debating material, the university radio with a sound educational programme of lectures, debates, music, drama, and vocational instruction, and in recent years a carefully thought out programme in the appreciation of drama, music, and art in the rural districts of Alberta. Adult education has been from the beginning, and is increasingly, a responsibility which the University has undertaken. It gives no certificates and exacts no standards in this work. It considers that its duty in this sphere is to stimulate and encourage, to assist and to advise, rather than to examine and to standardise. The contact between the University and the people of the province has become an intimate one because of this relationship, and one of the important functions of a state university in its stimulus to the people of the state has not at any time been lost sight of by the University of Alberta.

The wider contacts

The University of Alberta has entered into the society of the seventy universities of the British Empire, and has made its contacts through research relationships and through staff exchanges with many of the universities of that great company. It has in a still wider way taken its place among universities of the world, for it has intimate contacts with many of the universities of the United States, and has relationships with several universities of Europe. While much of the activity of a university is of local and provincial importance—and such activities will be indicated in the following pages—much of it has relationships wide as knowledge itself. A university cannot be restricted to a purely local setting, else it will languish and die. That is a sufficient reason why a university should seek for endowments to supplement the financial support which a state or a province may provide. All of the great universities of the

world have been generously endowed, and these endowments have been used to supplement the support which has been received from the state, or, in some cases, take the place entirely of any such support. It is not to be expected in the young country of western Canada that endowments on any very large scale can yet be possible. Certain endowments have already been built up. It is, however, important to realise that higher education, in state universities as well as in private institutions, is a responsibility which the wealthy members of a community have always shared in, and in so doing have given to the universities a greater freedom to engage in the wider relationships in the search for knowledge than may be feasible with the support which the state may find it possible to provide. The value of the work which this university carries on may be expected to find increasing appreciation among a people who, as wealth accumulates, will express their appreciation in endowments to their own university for the extension of its work in the field of knowledge.

A university is an institution for all time. It can only build soundly if it has wide vision and a far-seeing penetration. It cannot permit itself to be too seriously affected by the difficulties of the moment, whether in its spirit or its material wellbeing. For it has a carryover value, which is one of its greatest assets; and to maintain this value a continuity of purpose is essential. There is much in the history of the past twenty-five years for which all who have the interests of higher education at heart should be profoundly grateful. The future will bring with it its own challenge. We know that that challenge will make demands on the University of the best which it has to offer. The history of the first twenty-five years, short though the period is, shows that the University is accustomed to accept that challenge.

The university staff

There are three functions which are performed by the staff of the University—teaching, original investigations, and services as experts. The investigations which have been carried on by members of the staff over a period of twenty-five years are discussed later. Their work as teachers and as experts is dealt with here.

Teaching

The University is an institution where teacher and student meet. Not in the sense that opinions are created, though that is what many students expect when they come to the University. It is the function of the university teacher to build up the background, to supply the knowledge, to create the attitude of mind, which will make possible for the individual student a desire to reach sound conclusions on the basis of an impartial and critical review of all the evidence which may be available. It is his function as well to create enthusiasm in the search for knowledge, and to develop a critical attitude in the analysis of data. It is his privilege, such as is given to no others, to magnify the search for truth as the all important thing in life. It is his duty in the professional schools no less than in the college of liberal arts, to emphasize the fact that education will not come through the pursuit of a profession alone, but in interests wider than any profession can create. It is none the less the function of the teacher in the professional school to see to it that an exact and sound training is given in the fundamental sciences and arts of the particular profession, to meet the strenuous demands of modern civilization.

The value of this force acting on successive groups of selected young men and women over a period of a quarter of a century it is difficult to estimate. In such a field any estimate is an under estimate. The extensiveness of the work undertaken by this University has in itself provided the safeguard against exclusiveness and narrowness in intellectual sympathies. The teachers and students in the professional fields have rubbed shoulders with those of the humanities and pure sciences to their mutual advantage. The staff have represented the greatest diversity in training and in viewpoint. The method has been that of the lecture, the seminar, the laboratory, the case system, the clinic, the conference, the student club—with the lecture system predominating. There have been no research professors as such —except in the Research Council of Alberta. They have been primarily teachers, and in their spare time investigators. Whether in arts and sciences, medicine, applied science, agriculture, law, dentistry, household economics, pharmacy, commerce, education, nursing, or, in the affiliated colleges, theology, their service as teachers can be measured only by the mental equipment and intellectual enthusiasms of the 2,166 graduates who have passed through the university halls. By their fruits shall they be known.

Expert services

It has been recognized by the people of the province and in still wider circles that on the staff of the University there were men who could give assistance as expert advisers in their particular fields. Reference will be made later to the work in mineral resources, utilisation of coal, bituminous sands, power dveelopment, waste gas, and soils. In these fields members of the staff of the University have been directing forces. In problems of taxation, banking, transportation, grain-grading and marketing, nutrition, penal reformation, eugenic control, retarded development, medical jurisprudence, detection through handwriting, clinical judgment, and in the control and conservation of natural resources, fundamental service has been given to the province and to Canada by members of the university staff. The services of the first President with the Khaki College and in the directing of research call for special mention. Through the outstanding abilities of members of the staff, the University has been a force in the land, making for sound and wise planning in the field of the natural and the human resources of our country.

Public recognition

The ability of members of the university staff has been recognised in the honours which have been paid to them, and in the public functions which they have been asked to perform. Twelve have been elected to membership of the Royal Society of Canada, five of whom have been presidents of their sections, and one to the Royal Society of Edinburgh. One—Dr. Collip—has been elected to the Fellowship of the Royal Society of London, and shared in the Nobel Prize. Two have been presidents of the Canadian Universities' Conference, one of the League of Nations Society in Canada and one of the Association of Canadian Clubs. Two have been presidents of the Canadian Institute of Mining and Metallurgy. One was called to the presidency of the National Research Council of Canada, and two to the headship of divisions in the Council. One was appointed a member of the Board of Grain Commissioners of Canada. One has been invited to give a series of lectures at Oxford University and to address the Poetry Lovers' Fellowship in London, and one to give the Burwash Memorial Lectures in Canada. One is now a professor of classics in McGill University, one a professor of biochemistry in McGill University, one a professor of history in the University of Minnesota and one a professor of German in the University of Manchester. The members of the staff have had full recognition and have played an active part as citizens of the dominion and the

province. They have given prestige to the University in the university world.

The students

The University touches the general life of the province through its staff, its students, and its graduates. Some ways by which the staff exerts an influence are suggested elsewhere in these pages. But it might fairly be argued that those who teach at the University are chiefly influential through the young men and women who fill the class rooms and who later go out to earn their livelihood in different parts of Alberta or elsewhere. More than by anything else a university is judged by its undergraduates and graduates. It is they who show the worth of what the university gives. It is by their ability and their interest in truth that the place is justified or found wanting.

Following the lead of older universities, the successive generations of students in the last twenty-five years have developed for themselves a way of life which gives play to diverse interests and abilities. Athletics, debates, dramatics, the Gateway, student government, have required and encouraged the acceptance of responsibility and the exercise of different kinds of skill. By these activities a student learns how to live with his fellows, and he takes that lesson with him when he leaves the University.

The alumni

The University of Alberta having been in existence for only a quarter of a century, practically all of its 2166 graduates are under forty years of age. Indeed, two-thirds of them are not over thirty. About seventy per cent are at present living in Alberta, and only about eight per cent are permanently resident outside of Canada. Many of the men and women of the small group who had graduated by 1916 have already won distinction and have been prominent in the conduct of municipal and provincial affairs. The more numerous and more recent graduates will, one need not doubt, play their parts well also. Graduates are to be found all over the province, in town and country, performing the daily, almost unnoticed, professional tasks of teaching in church and school, of medicine and dentistry, of law and engineering. Some twenty graduates are members of the university staff, and about thirty others are at work in universities, colleges and research institutions in Canada, Great Britain and the United States. Half a dozen represent

Canada in foreign countries as trade commissioners. The civil service, business, journalism—each has its quota.

Each year sees fresh groups of graduates engaged in advanced studies here and elsewhere. Of these, one hundred and forty-six are known to have proceeded to the degree of M.A. or M.Sc. and forty-three to the degree of Ph.D. or D.Sc. All of our Rhodes Scholars have gained at least second-class honours at Oxford—most of them in the School of Jurisprudence—and a few have won first-class honours. Three of our graduates have been awarded 1851 Exhibition Science Research Scholarships. A graduate of 1924 took his D.Sc. in Harvard in 1927 and has this year been elected as the first holder of the Stringer Fellowship at King's College, Cambridge. A B.Sc. of 1913 joined the staff on graduation, served overseas, and after the war resumed his lectureship here. Later he took his master's degree at the Massachussetts Institute of Technology and is now on the staff of that institution. Another graduate, after taking her master's degree here, went abroad on a French Government Bursary, and took her doctorate at Paris. She is now a professor of French in Illinois. These examples, and it would be easy to add to them, show that the training our students receive enables them to go on to advanced work elsewhere with credit to themselves and to their first university.

Public services

There are avenues to public service which lie invitingly open to a university. They give access to activities which have no direct relationship to the students in the university halls. With the growth of the state universities, the services which a university may render to the state have become more clearly defined. Some of these services, as they have been performed in the University of Alberta, are outlined in the following paragraphs.

Extension work

The department of extension was established in 1912. It has since grown in order to meet the increasing demands for its services by rural communities. By now it may fairly be called an important element in the life of the province.

From the beginning, lectures on agricultural, economic, historical and artistic subjects have been prominent in its programme. A number of these are illustrated by lantern

slides. Combination programmes of lectures and moving pictures are also provided. In the session of 1931-32 members of the department and the university faculty gave nearly two hundred lectures to audiences totalling over twenty thousand.

One section of the department devoted to visual instruction has several hundred boxes of slides and films available for circulation. These are sent out to schools, churches, and community organizations, at a nominal rent, and often an operator is supplied to conduct the programme. Last year the total attendance at lantern slide lectures and moving picture programmes was over two hundred and thirty thousand.

The extension library renders an important service to the province. It consists at present of over twenty thousand volumes, about half of which may be borrowed by individuals with no charge except for postage. The remaining books compose the travelling libraries, and some three hundred of these are in constant circulation throughout the province. A library consists of about forty books and may be kept in a community for three months. Upon its return another selection is sent out. There is a waiting list of applicants of from twenty-five to fifty. No charge is made except for transportation.

Pamphlets and package libraries which provide material for debates and discussions and advice on the organization of debating societies may be obtained from the department. Inquiries on any subject are given careful consideration by the library or office staff. During the year ending March 31, 1932, nearly a thousand package libraries and over three thousand pamphlets were sent out.

A mailing list of approximately 5500 names (including the alumni of the University) is maintained, besides a special agricultural mailing list. Press bulletins are issued and weekly news letters. Agricultural bulletins are not published by, but are distributed through, the department. From January 1, 1932, to March 31, 1932, over one hundred thousand bulletins and circulars were distributed.

Every spring the department and the college of agriculture of the University hold a Farm Young People's Week, which offers a week's instruction and entertainment to young men and women from rural districts. The average attendance has been about two hundred, but three hundred and fifty can be accommodated.

In 1927 the department of extension, in co-operation with the department of electrical engineering, established the university radio station, CKUA. An effort has been made to supply programmes of high quality. Nearly five hundred lectures were given last year by members of the department and the university faculty and by prominent visitors on the campus. Experiments of different kinds have been made: a course in French pronunciation, for example, and the reading of plays specially written for radio production. Alberta students have debated over the radio with students in British Columbia and Manitoba. The regular musical programmes owe much to Edmonton artists who have given their time and skill to the department.

The grant of the Carnegie Foundation in June, 1932, for a period of three years, has greatly enlarged the activities of the department. The grant was for the specific purpose of encouraging art, music, and drama. Remarkable results have already been achieved. Art exhibits, accompanied by well-informed lecturers, have been sent out and have been enjoyed by many people. An instructor has visited over thirty communities in order to help in the formation of rural dramatic societies. Some two hundred and fifty groups have been given aid in choosing and producing plays. Forty-nine plays were submitted in the Carnegie Trust Fund play-writing competition, and of these fully twenty showed literary and dramatic merit. The appropriation for music is used for programmes and lectures over CKUA and also to encourage the holding of concerts in Alberta towns; but the major part is set aside to supply competent adjudication for rural musical festivals.

The department of extension, it may justly be claimed, has done something to foster intellectual and artistic interests in Alberta. During the past few years, the various extension services have reached one third of the population.

Faculty of agriculture

The public services of the faculty of agriculture in the University take the form of applied research work, advisory and consulting-work with both public bodies and private individuals, and the setting and maintenance of standards of professional agriculture within the province.

Under the first heading come the soil surveys and the extensive investigations of the problems of our wooded soils. Detailed maps have been prepared covering certain areas of the province in which the soils are classified into various types and graded as to their suitability for agricultural purposes. In addition to this, much work has been done in

studying the problems of management of wooded soils. A special bulletin dealing with the subject, based on several years' experimental work with the use of clover and alfalfa for building up these soils, has been printed and distributed.

The work in genetics, plant breeding, and plant biochemistry has been of very great value to the seed growers of this province. Work is under way to develop new drought-hardy strains of wheat, and considerable headway has been made in the study of disease-resistance in certain varieties of cereals. The department of field crops for years has been performing a valuable service in supplying elite stock seed to seed growers and at the present time is the only source of supply of this kind in the province.

The University preserves a very close contact with the livestock industry in the province through the department of animal husbandry. In addition to supplying high class foundation breeding stock to the breeders the University has clearly proved the suitability of Alberta for producing with home-grown feeds the very highest quality of beef cattle.

A great deal of work has been done in nutritional studies, particularly in connection with the role of minerals in sheep and swine production. The results of the annual feeding-trials with all kinds of livestock are eagerly looked forward to each spring by hundreds of livestock men throughout the province.

In the important field of agricultural engineering the University performs a useful service by investigating the use and adaptability of new machines which may be placed on the market from time to time. Furthermore, a series of practical handbooks dealing with the more common causes of trouble and poor workmanship in farm machines has been prepared and distributed.

A valuable contribution has been made in the field of horticulture in proving the varieties of perennial flowers, trees, shrubs, and fruits best adapted to this climate.

In dairying an intimate contact has been maintained with the industry, particularly on the manufacturing side, and some valuable work has been done in developing new methods for the production of clean milk.

The department of entomology has done valuable work in the study and control of insect outbreaks, particularly in connection with the grasshopper outbreak of 1922-23. Since that time detailed studies leading to practical results

have been carried out on wireworms and the relative susceptibility of wheat varieties to wireworm damage.

The poultry industry in the province has made practical use of the information gathered from nutritional studies in the department of poultry. Laying mashes have been developed that are now in common use, and a new significance has been given to the role of minerals in relation to successful poultry production.

In addition to such services as have been briefly outlined, all departments devote much time to supplying information to public bodies and private individuals by short courses, extension lectures, private interviews, publication of bulletins, circulars, press articles, and correspondence. Much service of a very practical nature is given in this way.

In setting and maintaining professional standards in agriculture, the college staff perform a service which in its long term effect is of incalculable value.

Department of geology

An example of the way in which the faculty of applied science serves the public is shown in the variety of activities carried on by the department of geology, where very useful work is done in determining the nature of minerals, rocks, fossils and stones, and in offering explanations and interpretations of peculiar physical features in different parts of Alberta. Small suites of minerals and rock specimens have been classified and arranged for a number of schools, and radio talks and public lectures given dealing with geological phenomena.

Provincial laboratory

Perhaps nowhere does the University more intimately and practically meet the needs of the people than it does through the provincial laboratory.

The provincial laboratory is a public health laboratory which serves as an adjunct to the various activities of the department of health in the prevention, treatment and control of infectious and other diseases, and also to the attorney-general's department in medico-legal services for the detection of crime.

This laboratory is a pure example of one phase of state medicine, and its services are available to all doctors in the province as well as to the public at large. The work performed comprises numerous types of bacteriological, pathological, serological and chemical examination, medical in nature and relation to the detection and control of disease.

An important phase of this work is the examination of water and milk, chemically and bacteriologically, to deter-

mine their suitability for public consumption, both from the standpoint of harmful ingredients and for evidences of pollution. In this way the sources of such epidemics as typhoid fever, epidemic sore throat, etc., are detected and steps for their control instituted.

Serological examinations, i.e., examination of the fluid content of blood and other body fluids, are of great importance in the diagnosis and control of venereal disease and also other diseases, for example, typhoid fever and pneumonia.

These tests, performed in the serological department, include such extensively used procedures as the Wassermann test for the diagnosis of syphilis, Van den Bergh's liver function test, the Colloidal Gold test for the diagnosis of disorders of the nervous system, including syphilis, and so are intimately associated with the prevention of mental and other diseases.

It will be realized that in many contagious and infectious diseases the diagnosis can only be made certain by the detection of the microorganism or bacterium which is the specific cause of the disease in question. This type of bacteriological examination plays a large part in the daily routine of the laboratory. An example of this is the diagnosis of gonorrhoea (Social Hygiene), only definitely established by the demonstration of its cause. The absolute diagnosis of diphtheria and tuberculosis is made only by bacteriological methods. Similarly the purity of smallpox vaccine is only assured by bacteriological control. The making and distribution of antityphoid vaccine and also other vaccines constitute another phase of the work of the bacteriological department.

The pathological department is concerned with the examination of diseased tissues, chiefly as an aid to diagnosis in surgery. Here material is examined for the detection of cancer and other diseases such as actinomycosis (Lump jaw), tuberculosis, syphilis, etc. Blood grouping, a procedure which is necessary before blood can be administered in safety in blood transfusions, forms part of the work of this department, as does also the examination of blood stains for medico-legal purposes. The recently introduced Ascheim-Zondek test for the detection of pregnancy in the early stages is available.

There is hardly any phase of public health work in relation to the control of disease in which the laboratory does not play some part, and facilities for the performance

of any necessary examination connected with these activities are provided.

Inseparable from the public health side of this work is the educational aspect, whereby modern laboratory diagnostic methods may be introduced to the profession and so made available to the public. Considerable study of the diagnosis and control of diseases of animals is also carried out, and various researches are in progress. During the year January 1, 1932, to December 31, 1932, sixty-four thousand six hundred and sixty-eight examinations were carried out, the commercial value of which, on the basis of moderate charges, may be placed at $144,960.20.

The field of research

The wide range of human knowledge is divided, for convenience, into different fields. But their dividing lines are never sharply drawn, for they merge into each other like the colours of the rainbow. These fields are not only expanding within themselves, but their relations to each other are continually changing, and any advance in one field has an influence upon the others. Science, for example, has not only given to the world that control over the forces of nature which is so essential to the progress of civilization, but it has also exerted a profound influence on the trend of philosophy. Science has reached its present stage by way of experiment, and each generation must acquire this heritage of the past and carry it forward by the same method. Universities therefore must be equipped with laboratories and teachers experienced in the methods of research.

The University encourages research primarily because it makes for better teaching. The critical spirit that comes with investigation permeates all other knowledge that the teacher possesses. It keeps his interest keen, and it adds a freshness to his lectures. The teacher engaged in research must keep himself informed of the work of others. This brings him into contact with men in the same field; it promotes the interchange of ideas and links the universities of the world together. Any piece of original work, properly done in any field of knowledge, brings immediate returns to the man who does it, to the students under him and therefore to the university and the public he serves. It is no

accident that the leading educational institutions are also foremost in research.

The contributions to knowledge made by a university are of a special kind which cannot well be made by other institutions. University research is largely a by-product of other activities. It is carried out in the teacher's own time, and the special requirements are often obtained by generous grants from outside the university. The primary object is the search for truth. But the discovery which is interesting in the beginning only to specialists may, in combination with other discoveries, be of value to the world at large. History shows how often new fields were first explored in a university.

The following pages will give some indication of the research work that has been done in the University of Alberta. It is presented under three main divisions, namely, the physical sciences, the biological sciences, and the humanities and social sciences. The physical sciences deal with matter and energy without reference to life. Their foundations are laid in physics and chemistry, their laws are expressed in mathematical form, and their applications are found in engineering, in geology, and in the bordering fields of the biological sciences. The biological sciences treat of living things and of those special problems of matter and energy to which life gives rise. The humanities and social sciences, on the other hand, are concerned with the study of man himself as reflected in his artistic creations and in his efforts to understand and solve the problems arising out of his social and political relationships.

The physical sciences

Geology

A young province like Alberta offers a wide field for research in many of the physical sciences. Its geology and resources have presented numerous problems requiring investigation. Extensive work on the geology of Alberta began in the University when the province was only seven years old. At that time geological knowledge of the country was fragmentary and incoherent. A summary of the information available was first undertaken, and a statement of the extent and importance of the mineral resources was prepared and published.

As a result of the many researches, the geological history of the province is being gradually written. The palaeogeography of this part of the earth's surface in different stages in the Mesozoic era has been interpreted in part, but much remains to be done. Researches into the life of the past have led to the recognition of new groups and families

as well as genera and species and have made it possible to correlate the life of these parts with that of other sections of America and even of other continents. The presence of well-preserved remains of vertebrates, particularly of reptiles represented by dinosaurs, has afforded opportunity for research which has proved of interest and value. Much material, some of which is new to science, has been added to the museum. Most remarkable of these new specimens are the bird-footed dinosaur Troodon and a new species of the turtle Aspirerites. Fossil footprints of one of the most primitive mammals in North America have also been found. The museum collections of minerals, rocks, ores and fossils have an appraised value of over seventy-five thousand dollars. In addition, the museum has sections representing archaeology and Indian and Esquimaux anthropology.

Various phases of the mineral resources have been studied both in the laboratory and in the field. Some of the minerals obtained were not previously recognized in Alberta. Extended investigations have been made on salt and gypsum deposits. These are among the potential mineral resources of the province. The composition and possible utilization of clays, sands and building stones have formed problems of considerable magnitude.

Specific researches have included the detailed study and correlation of three sections across portions of the Rocky Mountains in Alberta; the sediments deposited in the Colorado and Fernie seas and the fossils contained therein; the petrology and petrography of certain sedimentary rocks; and the various beds of volcanic dust recognized in the Mesozoic, Tertiary and even in the Quaternary deposits.

Many of the natural resources of the province mentioned above have been the means of directing laboratory investigations along special lines. But one problem leads on to others which may end in the field of pure physics or chemistry. These, however, will be omitted and only the main course of each investigation followed.

Particular attention has been given to the coal resources of the province. Approximately twenty thousand square miles of coal area have been investigated and mapped. The geological horizons and geographical boundaries of various coal seams have been determined together with the variation of characteristics, both vertically and laterally, in certain seams. Correlations of coal seams have been made between different fields extending into areas where mining has not

yet begun. A map has been prepared on which coal areas are shown according to the age of the formation, and names have been assigned to each of these areas. This map has been accepted by both the provincial and federal departments of mines, and all coal production data are expressed with reference to these areas. In 1925 a geological map of Alberta was published showing the distribution of all coal-bearing and associated formations recognized at that time. More recent field data are now being compiled for a revised map of central Alberta. The miscrostructure and composition of coal has formed the basis of special investigations, and some of the work initiated here has been continued at other universities. In compliance with a request from the Provincial Government an estimate has been compiled of the known coal reserves available for development within Alberta, and many special field problems have been investigated on behalf of the coal industry of the province.

Coal analysis

Researches on coal were commenced in 1921 in the University under the auspices of the Research Council of Alberta. At that time comparatively little was known as to the composition of the coals of Alberta or the geographical distribution of the different types. The first work undertaken was, therefore, a general chemical survey of the coals produced in the province.

Processes in commercial preparation and use of coal have in recent years become more and more complex, and the laboratory study of coal has necessarily become more complicated.

Many new methods of test have been examined, the better ones developed and standardized for the valuation of Alberta coals.

Although coal has been a material of great commercial importance for several centuries, no agreement has yet been reached as to its classification, and even such common terms as Anthracite and Bituminous still lack definition. Work on coal classification is in progress under committees in Canada and the United States. The coal studies in the University have repeatedly influenced the decision of both these committees.

The wide range of types of coal found in the province makes Alberta coals occupy a key position in the classification of Canadian coals, and an important position in the clossification of North American coals.

Detailed chemical and physical coal surveys have been made in Alberta in the past three years to gain information for both economic and classification studies. The first of these surveys was across the south of the province, the second across the middle, and the third was a less detailed survey, from north to south, of the coals marking the transition from the mountain to the plains type of coal.

An important research has been the study of moisture in coal. This work resulted in a simple procedure for determining the true moisture of the coal as it occurs in the seam and the presence of free or extraneous moisture in some samples, as well as the moisture-holding character of the coal. The oxidation of coal has been studied in its effect upon the moisture in coal and as a source of error in moisture determinations. The moisture of the coal as mined is found to be a good indication of the rank of the coal, and is found to be far more closely related to the distance of the deposit from the mountains than to the geological age of the deposit, or its depth.

The rank of a coal is also indicated by the percentage of alkali-soluble ulmins found in the coal. A reliable test for such ulmins was developed and employed in the coal surveys; this test was also employed for determining the oxidisability of coals.

Coals as mined contain mineral impurities, as indicated by the ash percentages reported in analyses. The mineral matter, however, is not the same as the ash, and the changes undergone by the mineral matter during analysis affect nearly all the determinations made. This problem has been studied at length and methods developed for closely approximating the true analysis of the mineral matter-free coal.

Methods have been devised and procedures standardized for studying friability, weathering, specific gravity and the fusibility of ash.

In the study of the coking properties of coals, such as softening and decomposition temperatures, and in the study of their solubility in organic solvents at different temperatures and pressures, much new work has been carried on.

The old established methods for coal analysis and examination were mainly developed in England and the eastern United States for use with the higher rank coals; some of these methods are not reliable for use with the lower rank, easily oxidised, coals mined in parts of Alberta. Many new

methods have been required for modern studies of these coals. A notable part of the work of the laboratory has therefore consisted in a study of the limits of accuracy of different methods of test when applied to coals of all ranks, in the design and construction of new apparatus, and in the development of new or improved methods for analysis for the above investigations.

The chain grate stokers installed under the boilers of the university power plant in 1914 were among the pioneer installations of the kind in Alberta. These stokers permitted the use of lignite slack coal which was formerly a waste product of the mines. The use of slack coal has now become general for steam plants in the province and represents a very considerable annual saving in the cost of operation. A number of tests on various Alberta coals have also been undertaken in the university power plant.

Bituminous sand investigations

The large undeveloped resource of bituminous sand in Northern Alberta presents a research problem which has received considerable study. The bituminous sand formation extends throughout an area of at least one thousand square miles along the Athabaska river. Exposures from fifty to one hundred and fifty feet thick appear at numerous points on the main river and its tributaries. The bituminous sand consists of a fine quartz sand associated with varying amounts of silt and clay, impregnated with a liquid asphalt. The asphalt is of excellent quality for refining into the various grades of asphalt used in practice, such as those for pavement and rural highway construction, roofing, paint, etc. The natural asphalt contains an interesting lubricating oil fraction which may prove valuable. It may also be converted into gasoline by modern methods of cracking and hydrogenation. Delay in development of this huge source of hydrocarbons has been due to economic causes. The region in which it occurs has been considered remote, suitable markets have been small, and petroleum products have been abundant and cheap. Changing conditions are removing these obstacles, however, and development of the northern bituminous sands will soon become a feasible project.

The principal technical obstacle to bituminous sand development has been lack of a practical method for recovering the asphalt from the sands for refining into marketable products. There are several general methods of recovery that might be adopted. The one the Research Council of Alberta has chosen as the most promising is based on the action of water in displacing oil from sand and in wetting

the silica in preference to oil. To make use of this action for separating the asphalt from bituminous sand, hot water must be used since the asphalt is too viscous at ordinary temperatures to move readily. Further, since the asphalt is heavier than water, air must be introduced in such a way that it will form a froth with the displaced asphalt and float it to the surface of the water in order that it may be preserved. Largely by the trial and error method, a procedure which works well in practice has been developed.

Scientific examination of hot water separation of bituminous sand has revealed that the method is dependent on the interplay of a tangle of factors. The bituminous sand containing fine quartz sand; silt and clay, bitumen and a variety of water-soluble salts along with the hot water and treating reagents added to cause separation, form a rather complicated colloidal system. Good progress is being made in determining the behaviour of this system under definite conditions and in determining the conditions to be imposed to produce a desired behaviour. The outcome of this line of study promises to be of value not only for the specific problem of bituminous sand separation, but for other problems involving bitumen, sand, rock powders and water, such, for instance, as the building of bituminous highways and pavements. This work was carried out with the assistance of the Research Council of Alberta.

The problem of waste gas

There has been a very large waste of natural gas in the Turner Valley field for several years. There are possibilities of manufacture of useful products from the gas, much of which is now burned in the air because of lack of sufficient market for the natural gas. These products are carbon black, benzene, methyl alcohol, hydrogen, and formaldehyde. Much work has been done in the University, in cooperation with the Research Council of Alberta and the National Research Council, in the investigation of this problem.

One phase of the work, that of the production of benzene, has been carried to the semi-commercial stage. Benzene is a good anti-knock fuel, and has therefore a considerable local market. It is also the basis of several important chemical industries. It is formed by passing the gas through a hot tube in a process known as pyrolysis. In the in the field plant which was set up in Calgary it was found that the weathering gas from the naphtha tanks gives better promise of a commercial success in this process than the ordinary waste gas from the field. There is some likelihood

that this process will be made use of in connection with the new absorption plant in Turner Valley.

In the synthesis of methyl alcohol from the gas, high pressures and fairly high temperatures are necessary. A laboratory was equipped with the facilities necessary for physical and chemical studies at pressures up to four thousand pounds per square inch and temperatures up to 500-550°C. A series of catalysts has been studied, some of which have proved to be useful in the synthesis of methyl alcohol.

Hydrogen may be obtained cheaply from natural gas. By the use of hydrogen, coal may be liquified and bitumen hydrogenated to produce a light oil. The various Alberta coals have been investigated from this standpoint: and the bitumen from the McMurray tar sands has been found to be a very suitable material for the production of light oil by hydrogenation.

It is important, from the standpoint of the estimation of reserves, to know whether the gas and naphtha in the Turner Valley reservoir are in liquid or gaseous form. An investigation of two phases of hydrocarbon mixture up to the pressure of 270 atmospheres was carried through the preliminary stages. The results, while of value in the practical problems in Turner Valley, were found to be also of the greatest theoretical interest.

Soil surveys

In different parts of the province soil surveys are being carried out with a view to determining their suitability for farming purposes. It is now generally known that some sections would never have been opened up for farming had similar surveys been available. Research work on soils includes their chemical and biological investigation and study of the effects of fertilizers upon the yields and composition of crops produced on typical soils from different soil belts.

The chemical researches first dealt with the composition of soils from the various areas under survey and later brought out the composition relationships of the soils from the different soil belts. Intimate profile studies were included. These studies brought out the very close dependence of the various soil areas upon climatic factors, such as precipitation, as well as upon native vegetation covering, and to some extent upon parent soil material. The mechanical properties of the soils are investigated along with the chemical studies. Some of the more special researches deal with the quantities and distribution of sulphur in the soils;

the effect of natural agencies upon the leaching of the soil; the base-exchange properties of various soils; the amounts of plant foods in the soil and their availability; the nature of the soil phosphates; the forms in which phosphorus is fixed by soils.

The bacteriological investigations deal with the rate of decomposition of organic matter in soils; the amounts of nitrates produced under different tillage and cropping systems; the kinds and numbers of soil organisms; the rate and nature of decomposition of virgin peats; the oxidation of sulphur in soils; the effects of weed killers upon the organisms and productive power of soils.

The fertilizer investigations showed the decided lack of certain plant foods in the soils from some areas. The wooded soils, for example, are lacking in nitrogen and phosphorus, while some of the black soils are deficient in phosphorus only. A remarkable increase in crop yields was obtained by the use of fertilizers on wooded soils. In some cases the fertilizers materially shortened the time required to mature the crops. The very general adaptability of legumes for the wooded soils was established contrary to the idea of many farmers that such crops could not be grown on these soils.

Distribution of iodine

Some of the earliest records mention the presence of goitre in the Edmonton district. It occurs also in other parts of the province, but more frequently in some areas than in others. It has been definitely shown by investigations in other places that there is a relation between the prevalence of goitre and the lack of iodine in food and water supply.

Last year a survey of the occurrence of iodine in the province was commenced. Waters from different localities have been examined, their iodine content correlated with the geological formations through which they passed and also with the prevalence of goitre in these localities. This work is being extended to include an examination of foods, minerals and soils in the different areas in order to determine their content of the same element.

Mathematics

In mathematics, investigations have been carried out in several applied fields as well as in pure mathematics, in analysis and geometry as well as in astronomy, mechanics, electricity and actuarial mathematics. For example, both graphical and numerical computation methods have received a good deal of attention. Graphical methods of integrating functions of a complex variable have been studied. The

hyperbolic functions which constantly arise in problems involving heavy chains and cables have been tabulated and made available for use in numerical work. The binary stars are of great importance in astronomy, in that they provide one of the chief means available to the astronomer of calibrating the universe. They serve for him the purpose that weigh scales serve in ordinary life. The determination of a single binary orbit involves a great deal of time and labour, but it is by the accumulation of data of this sort that one may arrive at a knowledge of the structure and extent of the universe.

Besides these researches many investigations have been undertaken by the University in the fields of engineering, physics, chemistry and mathematics. With the exception of engineering, the work in these fields is generally referred to as pure science. But there is no sharp division between pure and applied science. The discoveries of pure science frequently lead to new applications, while the achievements of applied science often make further investigations possible and sometimes suggest new lines of attack. As the following researches may seem somewhat disconnected, it is well to remember that they are only glimpses of widely separated areas in the forward line of science.

Work in applied science

In the past twenty-five years remarkable advances have been made in the science of metallurgy. Depletion of the richer deposits of the metals has necessitated the development of lower grade deposits and cheaper methods of mining. The application of electrolytic refining has resulted in the production of metals with a very high degree of purity. It is now well known that the presence of minute traces of a foreign substance changes the mechanical and physical properties of a metal enormously. This action is the principle underlying the production of alloys—one of the great achievements of the age. The development, properties and limitations of alloys are subjects for extensive research. One important limitation is in their ability to withstand wide changes of temperature. Because of its climatic conditions Alberta is interested in this limitation, and studies have been made in the University on the influence of low temperatures upon the mechanical and physical properties of carbon steels. The advantages of alloying materials in reducing the brittleness of steel, particularly under shock conditions, have been clearly demonstrated. These investigations received assistance from the National Research Council.

Finely divided lignite coal is sometimes found in sands used for building purposes. Investigation has shown that its effect upon the strength of cement mortar is negligible if the coal does not exceed in weight one per cent of the weight of the sand.

In a study of the dynamical properties of rubber cord used for aeroplane shock absorbers, it was found that the loss of energy during loading was dependent upon the rate of loading of the cord. This work was undertaken on behalf of the Air Board of Canada.

Winter flying in Canada depends upon successful methods of starting and running aero engines at low temperatures. This problem was investigated during the winters of 1920 to 1924, looking to the development of reliable methods of construction and operation which would avoid trouble, both in starting and running, from the carburetor, the cooling system and the lubricating system. Following the laboratory work, which was undertaken on behalf of the Air Board and with the assistance of the National Research Council, actual winter flying began in the High River station of the Royal Canadian Air Force in 1923. Successful winter flights were also made by a detachment of the Air Force which was sent to Edmonton for the purpose in 1927. These operations represent the pioneer work in winter flying in Canada.

Physics

During the war a method of detecting submarines by means of short waves in water was developed to some extent. A member of the university staff was attached to the British Admiralty in connection with the work. Extending over a number of years immediately after the war a series of investigations was made in the University on the properties of short waves in water and other liquids. These waves, which are only a few centimetres in length, are known as ultrasonic waves. Because of their convenient length many interesting points in general wave theory could be studied with precision, and many of their physical properties, hitherto unknown, were determined. Diffraction, interference, velocity and the distribution of energy in a beam are examples.

It is well known that icebergs are a source of danger to navigation in certain waters and the possibility of detecting their presence by means of ultrasonic waves was soon recognized. The apparatus developed here was therefore installed in one of the government ships, and experiments were carried out in the Gulf of St. Lawrence on the detection of icebergs. Reflections were obtained, and the results

were promising. It was recognized, however, that improvements in the apparatus would be required for detection at greater distances on account of the low reflecting power of ice. This work was carried out with the assistance of the National Research Council of Canada.

For four seasons investigations were undertaken with the cooperation of the Provincial Government of Quebec on the correlation of fire hazards in forests, the relative humidity of the air and moisture content of the surface layers of the forest floor. Although carried out in the Quebec forests the results have a general application and showed that careful determination of moisture content led to reliable criteria for the prediction of dangerous periods in the forests.

A study of the absorption of the ultra-violet light of the sun by the earth's atmosphere has been in progress for a couple of years. Much of this energy is absorbed by the ozone which is known to exist in the upper atmosphere. Comparison of this absorption with that measured in the laboratory affords a means of determining the amount of ozone present. The varying absorption of ultra-violet light has a vital bearing on the biological activity of sunlight and may also have an effect on weather changes. The ozone is in the neighborhood of the ionized reflecting layers of the atmosphere which play such an important part in the transmission of wireless waves.

The university broadcasting station has increased the facilities for research work in radio and is frequently used for experimental purposes. Many parts of the station have been designed and built in the University, and its operation has suggested problems of a technical nature which have been subjects of investigation. With the assistance of the National Research Council the anomalous properties of dielectrics have been studied for a number of years in an attempt to obtain more accurate laws of their variation with frequency extending into the radio bands.

Organic chemistry

For a number of years, in the division of chemistry, research has been done on organic mercury and arsenic compounds, from the standpoint of a possible therapeutic value. The antiseptic action of mercury inorganic compounds, more especially mercuric chloride, has long been known. The use of mercury in organic combination as an antiseptic is comparatively recent. Mercury when combined with a dye has the advantage of antiseptic action and also the property of fixation. Recent work in this laboratory

has proved that mercurated iodine fluoresceins are fairly active in killing Bacillus Typhosus, and much better than the corresponding bromine derivative (mercurochrome-222 soluble). Also it has been shown that the use of a chlorofluorescein or nitrofluorescein is not quite so effective. The antiseptic action apparently decreases with decreasing weight of the halogen. In the field of alkyl resorcinols (e.g., hexyl resorcinol S.T. 37) it has been shown that the introduction of an acid group (the carboxy 1) has a decided depressant effect on antiseptic action. Many of the latter mercurated compounds in alkaline solution readily decompose and give deposits of mercury, which fact excludes them from any useful action. The work on arsenic has mainly to do with derivatives of diphenyl ether. The latter grouping is particularly significant in such compounds as thyroxine.

Cooperative work has been done on the quantitative determination of nitrogen. Boric acid has been found to be particularly useful in the micro estimation of nitrogen, thereby eliminating the use of one standard reagent, viz., the alkali.

Spectrum analysis

The electrons in an atom of a given element may be regarded as capable of being arranged in a number of different ways called configurations, each of which is characterised by a definite energy value. When the atom changes from a configuration of large energy to one of lesser energy light is radiated from the atom. By measuring the wave length of the light the change of energy which has taken place in the atom is ascertained. A systematic study of the complete spectrum of the atom will therefore reveal the possible energy states of the atom. If one electron is completely removed from the atom, the remainder, which is known as the singly ionised atom, will have a completely new set of energy states. If the atom is doubly ionised by the removal of two electrons there will be yet another set of energy states and so on. A knowledge of all these possible states is necessary for an adequate understanding of the atom's structure. In order to make the measurements several types of instruments for photographing the spectra are required. For very short ultra-violet waves the light must be produced and photographed in a vacuum because the atmosphere is opaque to these waves. For this region of the spectrum the University of Alberta at one time held the distinction of having the most powerful instrument then in existence. By means of this instrument and of others for use in different regions of the spectrum, the spectra of a

number of elements have been investigated here during the last seven years. Of the elements on which work has been done may be mentioned calcium, scandium, titanium, zinc, gallium, indium, germanium, arsenic, cadmium, tin, tellurium, thallium, lead and bismuth.

In more recent years spectroscopists in many countries have been directing a good deal of attention to a new phase of their subject, that of the study of minute structure of spectral lines. It is found that some elements have lines in their spectrum which are not single but consist of a number of lines very close together. Such lines are said to have hyperfine structure, which in some cases is very complex. The cause of this splitting up of the lines is attributed to a property of the nucleus of the atom. It is therefore hoped that a study of hyperfine structure will in the near future help to solve one of the most baffling problems in modern physics—the structure of the atomic nuclei. Some work in this new field is now being carried on in the University of Alberta. The research work in spectroscopy has been made possible by liberal grants from the National Research Council of Canada.

Research in the biological sciences

Observation and experience tell us that all tangible or material things are either dead or alive; that is, matter is either lifeless or living. Everywhere there is a sharp line or division between living and lifeless matter, although the two are frequently so closely allied that first observations seem to show no distinctions. This is particularly true of those things that are not seen with the naked eye—microscopical things. Long and tireless observation and investigation are required to determine whether some of the bodies found in water are dead or alive. The contrast between living and lifeless matter forms the basis of the separation of the natural sciences into two divisions: biological and physical, the former dealing with living and the latter with lifeless matter.

It must be evident that all the sciences are interwoven; that a new fact discovered in one field affects the interpretation of things known in other fields. New facts are brought to light by searching for them. From known facts the deduction is made that a certain thing should be true.

It is then necessary to plan and carry out experiments that will prove the truth or falsity of the hypothesis. Research must have as its prime motive the sheer joy of discovery, the pleasure that comes from adding to the sum of human knowledge. Gradually there grows from these facts an application; it may be the use of electricity to add to man's comfort, something that was not in the mind of the physicist who discovered it, nor in the minds of those who first studied the problems that had to be solved in order to understand this mysterious force; it may be the application of genetics to produce various strains of wheat, each suited to certain conditions of soil and climate, or to produce different strains of farm animals each adapted to a particular purpose; or it may be the application of a discovery like insulin to the treatment of disease and the promotion of health and happiness.

Biology is the science that treats of living things, whether animal or plant, normal or abnormal. An enquiry into the biological research that has been carried on in our own university reveals that a large number of problems have been attacked and that much new knowledge has been gained. Some of this quickly found practical application; much waits for new discoveries to be made here or elsewhere before it can yield its full results; all adds to man's knowledge, health, comfort and prosperity.

Botany

In botany since 1900 concerted effort has been made in all countries of the world to arrive at an understanding of the conditions which favour the appearance and development of different types of vegetation (plant communities) and the laws which govern their change under certain environmental conditions. Such work is being carried out in New Zealand, Australia, India, Africa as well as all European countries and the United States. The desirability of carrying out studies in the ecology of the vegetation in the newer countries of the British Empire, for both the purely scientific and also the economic interest of the work, was fully discussed at the Imperial Botanical Conference held in London, 1924.

Natural vegetation in any part of the world consists of a series of plant communities within the primary divisions of desert, grassland and forest whose composition and character are determined by the environment, and which pass through a definite series of successions which lead eventually to a more stable or climax type of vegetation. There are then two aspects of such studies: first, the grouping of the vegeta-

tion of a country into definite plant communities and secondly, the study of the succession of these types. Such studies often present very complex problems which can only be solved by a study of the factors of soil, climate and the history of the vegetation of the country during recent geological eras.

Detailed studies of this nature have been carried out in the University since 1923 and have been mainly concerned with the plant communities of peat bogs (muskegs), sloughs, coniferous forest, poplar forest and sandhills. In the course of this work detailed observations have been made on these communities, their relation to one another and their successions to climax types characteristic of different parts of the country.

It has long been known that the coats of pollen grains are extremely resistant to decay when buried in peat bogs, and it has become possible by an examination of the peat at successive horizons in a bog to reconstruct the types of vegetation covering such areas since the ice of the glacial epoch receded.

One of the foremost workers in this field is Dr. G. Erdtman of Stockholm University, who has had long experience in applying the method of pollen analysis to the elucidation of the history of the vegetation in nearly all countries of Europe and the British Isles. In 1930 Dr. Erdtman wished to extend his studies to North America and as a result of the ecological studies carried out here chose this university as his centre. His visit, which extended over eight months, was made possible by a fellowship from the Rockefeller Foundation. Later Dr. Erdtman extended his observations to some regions in Eastern Canada and the United States. His visit will undoubtedly add much to our knowledge of the succession of vegetation in this country.

Arising out of the investigations of sandhill areas, detailed studies have been made of the structure, life history and means of distribution of the parasitic plant *Arceuthobium* (one of the mistletoes) which attacks great areas of jack pine in western Canada. Further studies on the method of reproduction, means of distribution and the infection of this parasite by a fungal parasite have been carried out by a former student of the department at the University of Cambridge and the University of Manitoba.

From 1918 to 1924 investigations were made on the physiology of the leaves of evergreen coniferous trees, par-

ticularly with reference to their resistance to extreme climatic conditions. Some of the problems opened by these studies are being pursued at the present time.

The cost of these investigations was partly borne by grants made by the Government Grant Committee of the Royal Society, London, and the National Research Council of Canada.

Zoology

Researches in zoology have followed a variety of lines. The most important single investigation, carried on for a number of years and still in progress, has concerned the general principles underlying the migration of birds, a particular phase of the wider topic of animal behaviour. After several years of preliminary study of birds and their migrations in Alberta, a series of experiments was begun in 1924. While these have produced much of interest that is new to biology, the most important outcome has been the discovery of a general principle that has subsequently been proved to apply to a variety of animals by independent investigators in other parts of the world. This series of experiments has received the financial support of the Government Grant Committee of the Royal Society of London, the U.S. National Research Council, the Bache Fund (Baltimore) and the Elizabeth Thomson Fund (Cambridge). In its later application the investigation has shown that it is possible to induce reversed migration in certain birds in the autumn. Such experimental interference with an inherited custom of many centuries' standing is a matter of scientific interest and has direct bearing on certain trends of modern biological thought.

Sharing certain fundamental problems with the question of migration, the periodic fluctuations in the numbers of rabbits, grouse, fur-bearers and other animals throughout Canada have received considerable study in the past and are the subject of a special investigation at the present time. The underlying principles are again the focal point of the study. There is little question that they have a direct bearing on human health in the Canadian north apart from the direct transference of such diseases as tularaemia from rabbits to man.

Investigations into the mechanism of sex are in progress. These include an inquiry into the causes of intersexuality in the pig and an attempt to duplicate the condition in the cat and rat, and a study of the influence of hormones on the secretion of the sex glands.

Various embryological studies have been completed, or are at present in progress. They include particularly the development of the small fresh-water polyp, Hydra, the material being obtained from certain Alberta lakes in which occurs a giant race of hydra, new to science until recently described and named *H. canadensis*. A study of the early development of the loon, one of the most primitive birds, has been productive of many points of phylogenetic interest.

Biological investigation as applied to agriculture has been carried forward vigorously in the various departments of the faculty of agriculture.

Animal husbandry

Investigation in animal husbandry has been conducted in the two main branches of the science, namely, animal nutrition and animal breeding. In these two fields, problems peculiar to Alberta have been particularly emphasized.

Nutritional problems have appeared the most urgent and for that reason have occupied the larger field in the research programme of the department. Studies covering a period of several years have centered around the comparative feed values of various concentrates and roughages and the influence of various feeds on growth, milk production, economy of gains and quality of product. Special attention has been given to the protein, mineral and vitamin requirements of animals at various stages of growth, together with the influence of these factors on resistance to disease. This has involved feed lot trials, together with the chemical analysis of feeds and biochemical studies on blood and bone.

In cooperation with the National Research Council of Canada, a study is being made of the influence of such environmental factors as temperature and humidity on the growth and quality of wool. Detailed laboratory analyses of many samples of wool from representative groups of sheep, maintained under controlled conditions, have been made.

Research in the field of animal breeding has been largely concerned with such problems as the effect of early breeding on the reproductive capacity of ewes when carried on over several generations, and the influence of such factors as sex and age in beef production as they affect the rate and economy of gains and the quality of the carcass.

Poultry

Difficulties encountered in raising poultry have received attention also. Chief among these is failure of the chick to develop properly while in the egg or after hatching. Investigations are being made into the cause of mortality in the

chick embryo and the dietary requirements of growing chicks. In studying the latter particular attention has been given to the amounts of protein, calcium and phosphorus that should be present in the diet.

Dairying

Bacteria are the major cause of the defects and deterioration of milk and milk products. The department of dairying has, for this reason, interested itself in studies of the bacteriological quality of dairy products as manufactured under Albertan conditions. The sources of most of the bacteria found in milk are being located, and milk of very low bacterial content has been produced on sixteen farms in the Edmonton district by slight modifications of common dairy practices. These investigations are being carried into the field of butter manufacture, and the sources of contamination of butter by bacteria, yeasts and molds, and the elimination of such contamination, are receiving attention. Such studies involve the use of methods for counting microorganisms in milk and other dairy products. These methods are being subjected to close scrutiny with the aim of determining and eliminating sources of inaccuracy.

Entomology

The major problem that has occupied the attention of the department of entomology during the summer months has been a study of the bionomics of wireworms. This subject has, heretofore, received very little attention. Apart from crop rotations, which are not applicable to the control of the major species that occur in Alberta, such control measures as have been employed are not based on ecological considerations.

In the main they are entirely inadequate. The lack of precise biological data is due largely to the great difficulty that is encountered when attempts are made to develop a technique whereby these subterranean insects can be kept under approximately natural conditions and yet be subject to observation and experiment. The fact that individual wireworms live for upwards of seven years adds to the difficulties of the investigator. Through frequent modifications of laboratory and field technique we are gradually adding to our knowledge of the effect of such ecological factors as we are able to control upon the activities and the survival of wireworms in all stages of their development. It is too early to state whether a study along lines such as those in progress here will lead to the development of control measures that will prove to be effective because biologically sound.

Other investigations have been conducted in connection with the biology of grasshoppers and of wheat-stem sawflies,

and the development of control measures particularly suited to conditions that pertain to Alberta. These have already saved this province several millions of dollars.

Field crops

Research in the department of field crops has been promoted in three general fields: genetics and plant breeding, plant biochemistry and plant pathology. A number of the research projects in this department have been carried on with financial assistance from the National Research Council.

All purely genetical researches have grown out of, and have been vitally related to, plant breeding or other agronomic investigations. One of the earliest researches in this field was a study of the origin of the false wild oat, a wild-like form of oat which mysteriously appears, often in supposedly pure breeds of the best varieties of oats. Work during the last two or three years has given strong evidence that these adulterant forms arise through natural crossing betwen cultivated varieties of oats and the ordinary wild oat, and subsequent segregation of the forms of so-called false wild oats. A knowledge of the true origin of these adulterants is important in designing methods for maintaining the hereditary purity of valuable varieties of oats.

The genetical relation of red-coloured and white-coloured wheats has been studied with a view to discovering the hereditary factorial basis of the colours of kernels in various economically important varieties of wheat. Knowledge acquired in this study has thrown some light on the occurrence of white-coloured kernels in supposedly pure red-kerneled varieties.

Three economically important characters in wheat—drought resistance, winter hardiness and disease resistance—are being studied intensively in regard to their genetical bases and their modes of inheritance. These studies and others on oats, barley and flax, may be expected to give rise to breeding projects seeking to incorporate these characters in true breeding behaviour with other desirable economic characters, for example, high yielding capacity, stiffness of straw, etc.

Analytical studies of the genetical constitution of alfalfa and of timothy are now under way, as well as cytological studies of the number of species of *Medicago* and of *Agropyron*.

Plant breeding work in the department during the past fifteen years has resulted in the production of twelve new varieties of wheat, oats, barley and other field crops of economic importance. Some of these have been registered in the Canadian Seed Growers' Association.

Plant biochemical studies in the department have varied considerably in kind, but have in general centered around economic aspects of wheat. The first problem undertaken was an investigation of the chemical or physico-chemical nature of winter hardiness in winter wheats. The practical aims of this research have been to place the problem of breeding varieties resistant to winter-killing on a sounder basis and to develop a reliable method by which the hardiness of new strains or varieties may be determined without elaborate and long-time field tests.

Studies have also been made of the reasons for differences in the resistance of plants to drought. The effect of various preceding crops on the yield and quality of a subsequent crop of wheat has been investigated, as has also the effect on the quality of wheat of freezing at different stages of maturity. The relative milling and baking qualities of the varieties of spring wheat grown in western Canada have been determined.

Plant pathological investigations have been largely directed toward a solution of problems occasioned by the infestation of our soils by fungi causing root-rot diseases of wheat and other cereals. Investigations of diseases caused by seed-borne microorganisms have also received or are receiving considerable attention. Among these are the smut diseases of cereals and western rye grass, bacterial diseases of wheat and certain grasses and the browning disease of flax. The possibility of controlling weeds biologically by means of fungous pathogenes has been investigated and the conclusion reached that effective and dependable control by this method need not be expected under Alberta conditions.

In the field of medical science research has been active in the various departments since their inception.

Anatomy

Morphology, or anatomy, is that part of the science of biology that deals with the form, structure and origin of living things, together with their arrangements. Gross anatomy, using dissection as its chief method of examining the construction of the body, demonstrates that while all human bodies are much alike and can be described in the same terms, each differs from the others in detail, and has

marked individuality. Minute anatomy, on the other hand, discovers by the aid of the microscope a wonderful uniformity in the fine details of the materials and structure of the normal human body. In a similar way the medical practitioner finds patients suffering from the same disease, yet each with differences which must be treated differently. This diversity among individuals combined with uniformity of the race gives perennial interest to the study of anatomy. The anatomist is necessarily an investigator. There have been carried on in the department of anatomy a number of special researches, including the structure and development of the muscles and of the nerves of the heart, the development of the brain, the nature of twins and triplets, medico-legal evidence in human remains, and study of vertebrate fossil material. To further the work on the brain a grant was made by the Banting Research Fund.

Bacteriology and associated sciences

The departments of bacteriology, hygiene and pathology have been cooperating in an investigation into the efficiency of the B.C.G. (Bacillus of Calmette and Guerin) vaccine as a preventive against tuberculosis in cattle. This work has been carried out under grants from the National Research Council of Canada. Briefly, the specific objects have been to determine: firstly, whether or not B.C.G. vaccine is harmful to cattle; secondly, whether B.C.G. vaccine has the power of developing, in animals inoculated with it, resistance to infection by tuberculosis and if so, to what degree; and finally, if B.C.G. vaccine has definite protective properties, what the most practical methods of using it are.

These investigations, involving the use of a large number of cattle, require considerable time for the correct assessment of results. They have been under way for over eight years and are still being carried out. At the present time it would seem that this vaccine might have a definite value in the struggle against tuberculosis in cattle. The basic reason for these studies in cattle is, of course, the possible development and application of suitable methods to protect human beings against the same disease.

In addition, special investigation of certain diseases has been made. The first bacteriologically confirmed case of Tularaemia in Canada and two interesting types of malignant disease, Multiple Myeloma, a malignant bone marrow tumor, and Neuroblastoma, a malignant tumor of the adrenal, have been investigated and reported.

Biochemistry

Biochemistry concerns itself with the materials used in the making of living things, plants and animals, or or-

ganisms. The biochemist is primarily a chemist, but it is well that he have a training in botany and zoology and better still that he have in addition some knowledge of agriculture and medicine—the fields in which the subject is now of most importance.

The department of biochemistry was not long established before it was made famous through the brilliant work of its first head, Professor J. B. Collip, now of McGill. Collip had already done work on respiration and other topics when he joined the Toronto group studying insulin. During that year's leave of absence from Alberta he contributed substantially to the preparation of a pancreatic extract which could be administered without harmful effects and indeed with the most beneficial results to people suffering from diabetes mellitus. On his return to the department with an international reputation, he showed that an insulin-like substance is present in certain plants, having worked no doubt on the assumption that since plants are also organisms which need sugars to live upon just like animals, they must also have a similar need for a substance like insulin.

It falls to the lot of few men to take part in more than one great discovery, so it was to the surprise of many that a short time later he published the results of certain work on the parathyroid gland which has proved of even more far-reaching importance. By means of an extract of this gland he was able to relieve a condition known as tetany, found in children with rickets and in certain adults who have had the thyroid gland removed on account of goitre. The extract has also been useful in leadpoisoning. Its action is apparently primarily on bone and in a reverse direction to the action of Vitamin D. Partly through the work of Collip it has been made manifest in the last year or two that a certain disease, known as osteitis fibrosa, in which the bones of the body are gradually eaten away—become soft as rotten wood and frqeuently fracture—is due to an over-function of the parathyroid glands often through the presence of a tumor. Surgical removal of the tumor leads to arrest of the disease. This work received substantial support from the Carnegie Corporation. One need not try to assess the value of Collip's work to the province. Such achievements command the respect of the outside world and are a source of legitimate pride to ourselves.

Under its present head the department has become better equipped for low temperature distillations and for spectrographic investigations of body fluids and cell pigments.

Partly through the generosity of the Banting Foundation, it has been possible to pursue an investigation on a hormone from the adrenal gland which preserves the lives of those suffering from Addison's disease. It is indispensable to the life of one patient who has now been supplied with the extract for upwards of two years. An endeavour is being made to gain more knowledge of the chemical nature of the active principle.

Work is in progress on the relation of iron and copper to the condition of anaemia. In co-operation with the poultry department important observations have been made on the copper and iron content of the developing chick embryo and the relation of those metals to the genesis of the blood pigment, haemoglobin.

Preliminary experiments have been carried out with a view to the investigation of the absorption spectra of the blood serum and tumor extracts from patients with cancer. A European claim to detect early cancer by this means has recently been made.

Physiology

Physiology is the study of the vital phenomena manifested by animals and plants. It treats of the function, or work, of the various parts of the living organism, and the contribution each one makes toward the economy of the whole. When physiology is applied to man it is called human physiology, for the great and ultimate aim of all physiological studies is the understanding of the functions of ourselves. An understanding of the normal operation of the body is desirable not only for the sake of the knowledge itself but to determine a rational way of living, and is necessary as a foundation for the study of departures from the normal, that is, disease.

In this department of the University several groups of investigations have been carried on.

One problem upon which a large amount of work has been done is that of the maintenance of normal composition of the blood as regards the formed elements, with particular attention to the mechanism by which a proper number of normal red corpuscles in the circulating blood is secured. The work here has been upon the internal secretions of the spleen and duodenum; and an attempt has been made to determine the part possibly played by these hormones in regulating the red corpuscle content of the blood in health. From the results of these experiments there has been developed a suggestion as to the usefulness and mode of oper-

ation of these agents in promoting blood regeneration in anaemia.

Voluntary muscle has also been studied, particularly fatigue of muscle and changes in physiological properties that occur when this condition develops. Work has also been done in the department on the validity of the all-or-none law as applied to voluntary muscle.

Another large subject, of which some aspects have been studied very thoroughly, is the regulation of respiration.

Changes are induced in living organisms by the administration in a state of minute subdivision of such unorganised substances as do not act merely as foods. Many of these substances are used to counteract the effects of disease or to reinforce the tissues in their struggle to maintain their functions. These substances are known as drugs. Others are of little or no value in disease, but are of importance because they act as poisons. Some drugs may also act as poisons.

Pharmacy, pharmacology and therapeutics

Pharmacy, pharmacology and therapeutics are closely related. The first is interested in discovering new drugs and in elaborating methods of their preparation, the second tries to evaluate new remedies, and the third develops their use in the treatment of disease.

The department of pharmacy has been acquainting itself with the drugs used in Chinese medicine. These remedies have been in use for centuries. A numbre of the medicinal agents used by the Chinese practitioner have found their way into occidental pharmacopoeias, and there can be no doubt but that more will follow.

The explanation of the symptoms induced by chemical substances belongs to the field of pharmacology. The great interest of pharmacology lies in its relation to the treatment of disease. As long as we are ignorant of how a remedy acts in any disease, the treatment is purely empirical; when the mode of action is understood much greater accuracy can be attained in the treatment.

In this department of the University the major problems under investigation are those of tolerance and addiction. The list of alkaloids studied up to the present comprises morphine, caffeine, theobromine, theophylline and cocaine. In the case of cocaine an inquiry has been made into the marked idiosyncrasy that frequently manifests itself when cocaine is administered. This extreme susceptibility to the drug is usually responsible for the fatalities that follow its use.

The cause of death in cocaine poisoning has been found and an attempt made to develop a means by which a fatal effect may be prevented.

A thorough study has been made of the pharmacological actions of a number of hypnotics of the barbituric acid series. Those studied have been classified according to effectiveness as hypnotics, as analgesics and as anaesthetics, and also according to undesirable actions and toxicity.

Medicine and surgery

The departments of therapeutics and pharmacology co-operated in an investigation of a new anaesthetic, divinyl ether. This was the first occasion on which this anaesthetic had been administered to a human being, members of the staff volunteering to serve as subjects. These experiments demonstrated the effects of the drug on the human organism and its superiority in many respects to the anaesthetics in general use.

The department of the practice of medicine has discovered a new disease of the oral mucosa, has perfected a treatment of pneumonia, has carried out a clinical research on the diagnosis and treatment of early neuro-syphilis and has studied the effect of treatment of Addison's disease by an extract prepared from the cortex of the adrenal gland. Investigations have also been going on for a number of years on problems of metabolism.

Several members of the department of surgery have reported a number of unusual cases that have come under observation and in some instances have developed new methods of treatment.

Dentistry

The department of dentistry has been striving continuously to improve dental technique. Casting processes in making gold inlays, more satisfactory moulds for artificial teeth, and cavity preparations of a special nature have been the principal items in the research programme of the staff.

The results of much of the University's biological research have been made available to those working elsewhere by publication in appropriate journals. The number of such articles is over five hundred in more than seventy journals.

The humanities and the social sciences

The humanistic studies naturally divide themselves into two groups. Languages and literature constitute the first group, the human or social sciences the second. While we are concerned in both groups with the study of man, in the case of the first we seek to appreciate the uses to which man has put his greatest institution, language, and especially the manner in which he has used it to intensify and expand his spiritual life; in the case of the second group we attempt to appreciate in our presentation of history, economics and philosophy the efforts of man to cope with the problems arising out of his social and political relationships. In regard to literature, it may be remarked that for reasons which need not be considered here, this is probably the most significant of the arts for the purposes of education.

English literature

The mother-tongue must always be accorded an important place in any well devised programme of literary studies. Those engaged in the teaching of English literature in the University of Alberta have had before them one very obvious purpose: to make our students feel that the great books of the language are part of their natural heritage as English-speaking people. That there are real difficulties in the way goes without saying. Many of our students find it hard to overcome a sense of remoteness from a great part of English literature, especially that of the earlier periods. That literature is the outcome and expression of a way of life and of a culture so different from that of western Canada that what is universal in the poetry and prose may easily remain unperceived, so hidden is it under what is peculiar to its century and place of birth. The only way to a fair measure of success is to be ever aware of the difficulties which stand in the way of a student's understanding and enjoyment. It is easy to forget that many undergraduates have never seen the sea, or a mediaeval building, or a great city; and yet an immense body of English literature assumes familiarity with such things.

To lessen and, if possible, to remove the obstacles which keep young readers from the English classics is a task well worth attempting. In shaping courses and in seeking methods of teaching, the English department, like many others in the University, has found it an advantage that its members have not been trained in one university or in one country. The fact that the universities of Oxford, Harvard, Chicago, Toronto and Alberta are all represented has, one may hope, tended towards variety and flexibility.

Modern languages

The study of foreign languages has always been considered an important means to a humanistic training. Such study has two objects in view; the practical object of learning to speak the language and the broader object of achieving some measure of appreciation of the culture of foreign peoples. Both aims have been kept in mind by those responsible for the teaching of foreign languages in the University of Alberta. The exception is the case of Spanish in which a two-year course of a practical colloquial type is offered, with enrolment restricted to students registered in the school of commerce.

One college year of language work subsequent to matriculation should equip the student with a sound linguistic tool, useful to him in other fields of scholarships, while for the student with special liking or aptitude for language study more advanced courses are open. An honours degree may be taken in French and German, or in a combination of French or German with Latin.

On the French side the University has always openly recognized that Canada is a bilingual country. A serious effort, therefore, has been made in the national interest to give English-speaking students a practical command of the French tongue. The work of the lecture room is supported by the acting of French plays and by the programmes of a very active French club. Members of the local French-Canadian community, containing numerous cultivated people, are constant attendants of the club's meetings, lend it much appreciated practical support and give a reality and naturalness to its proceedings which contribute largely to its success.

In regard to modern language courses generally, it is a matter of policy, so far as possible, to break the classes into small groups, so that the language itself may be made the medium of instruction.

Classics

It would be generally agreed that the main fountain-head of the European cultural tradition is the ancient civilizations of Greece and Rome. The study of the classical languages and literatures is thus one of the traditional disciplines of the higher learning. Those in the University of Alberta who have had charge of this branch of instruction were bound to take into account not merely the standards and ideals of the classical tradition but also the question of their applicability to the University's constituency. With only a limited linguistic training available in the secondary schools of the province, it appeared unreasonable to expect to develop classical scholarship along purely philological lines such as

were being principally pursued in the European and North American universities twenty-five years ago. In the nature of the case, therefore, it would be preferable to follow some other avenue in dealing with the classical tradition in the province of Alberta. In consequence, while always endeavouring to stimulate in their students a desire for greater perfection in handling those intricate mechanisms of speech which are essential features of Greek and Latin, the teachers have made it the object of special effort to present a civilization rather than that civilization's formal expression in language. Recognizing that a classical training affords men and women of the modern world an almost unique opportunity to view with detachment their own civilization if emphasis is placed upon the views and ideals of antiquity, the instructors, while providing the usual courses in Greek and Latin, have particularly stressed the significance of those courses as indicative of ancient life and thought. They have further brought the various items of special information acquired in this way into their proper place in a larger scheme by offering courses in Classics in English, in Greek and Roman history, and in the family and community life in the Mediterranean. It is thought probable that, as a result of these courses and of the general view of the correct relation of classical antiquity to our own very newly developed culture in Alberta, our undergraduates possess an unusual equipment for appreciating the debt of the modern world to Greece and Rome. For many years, also, large numbers of students have been introduced to an appreciative study of the great masterpieces of Greek art. In this as in the courses in general, the consistent use of a library of representative slides illustrating Greek and Roman life and art has been of the greatest value.

Honours students, on the other hand, are given much careful instruction in the more minute points of syntactical and textual scholarship, and the success of these students in the graduate schools would seem to attest the sufficiency of the grounding thus provided. Senior students, also, in upper class divisions, have always been given a reasonable measure of instruction in the finer points of classical scholarship, but a careful distinction has been regularly maintained between the needs of the specialist and those of the general student.

History

In connection with the social sciences, three main lines of interest present themselves: mediaeval and modern history, economic science, and philosophy. As indicated above,

the teaching of ancient history in the University of Alberta has been entrusted to those who are specially versed in the study of the ancient civilization. So far as mediaeval and modern history is concerned, the main problem in the early days of the University was that of the organization of fundamental courses, first for students proceeding to the general arts degree and later for those desiring to take honours. In these courses the aim has been to afford junior students a survey of wide fields of history and to acquaint senior and honours students more intensively with significant periods or aspects of history. Not only political and constitutional but also economic and social developments have been held in view in order to effect correlation with such kindred studies in the humanities as literature, political economy, political science and philosophy. Though in some courses textbooks have been used, the effort has been to establish the habit of reading to develop the faculty of judgment, to give the student an appreciation of the origins of our civilization and of the story of its growth and, finally, to create an active interest in its problems. In some instances students have been able to proceed from this training to historical research of some worth at other institutions. Graduate students have also made a beginning in research work relating to western Canada, while it is hoped that training of value has been given to many students for teaching in the secondary schools of the province. Members of the department also by articles and addresses have been able to do something to familiarize the public with the work of the League of Nations and with current problems of national and international affairs.

Political economy

Political economy became differentiated as a separate field in comparatively recent times. The reason for such differentiation is not far to seek. The economic structure of our present-day society has become so intricate that all universities now recognize that the relevant problems can no longer be adequately dealt with as a side issue of political philosophy: they must be studied directly. The primary object of this branch of study in the University of Alberta has been to acquaint the students with those methods of thought which have been found useful in formulating generalized descriptions of the uniformities of collective human behaviour in the economic sphere, with the content of the more elementary generalizations which have thus far been developed, and with their application to a necessarily limited range of problems important in the modern world. Since

economic activity is so pervasive, it is not surprising that the students in the political economy classes are widely drawn from among the various schools and faculties of the University: arts, commerce, household economics, agriculture, pharmacy, applied science and law.

The specialists in economics are of course frequently called upon to deliver public addresses on economic subjects of current interest and to answer a stream of enquiries from the public for reading references. While it is physically impossible for them to read any large part of the popular quasi-economic articles of questionable merit which currently appear, they are frequently able to direct the enquirer to standard works on the problem in which he is interested. From time to time, also, they act upon or give evidence before governmental boards, committees and commissions. It will be recalled that important services of this kind were rendered by Dr. MacGibbon as a member of the Royal Grain Enquiry Commission and as commissioner to investigate banking and credit in Alberta. The demands on the time of these specialists are, it will be seen, numerous and varied. It is sometimes necessary, therefore, to refuse requests for addresses or consultations in order that the less pretentious, but fundamentally more important, duty of instructing and advising the students of the University may not be slighted.

Philosophy

One of the humanistic studies in which universities have always been interested is philosophy. When we study the story of philosophy, we seek to understand man's attempts to achieve a final synthesis of his many-sided activities, his attempts to see life singly and see it whole. At the university—for the first time in his career—the student is given the opportunity to achieve some measure of appreciation of man's efforts in this direction. Appreciation implies not only that the student sees what the fundamental and persistent problems of philosophy are, but that he catches something of the spirit of free, honest and fearless enquiry in which the problems have been approached. Ethics, or moral philosophy, deals more specifically with man in his relation to his fellows, as the sharer of rights and duties, and seeks to account for his judgments of right and wrong, of good and bad, as applied to conduct. The aim of teaching in this connection is to interest the student in such questions and at the same time to give him a training and a historical background that will enable him to take a larger and more adequate view of the ethical issues arising in his own day and generation.

Psychology

Psychology, on the other hand, aims at furnishing a scientific account of the working of the mind. There are three well-defined fields each of which has its own special significance in relation to present-day culture: laboratory psychology, applied psychology and systematic theoretical psychology. The policy of those responsible for this study in the University of Alberta may be summed up by saying that they have aimed at maintaining a close connection between the academic and the practical aspects of the study with the twofold object of preventing the former from becoming "academic" in the bad sense and the latter from becoming superficial and fragmentary. It may be remarked that their relationship to the Canadian National Committee for Mental Hygiene has helped in important ways towards the realization of that aim.

Education

The school of education has been conducted in close association with the development of the philosophical and psychological studies. The relationship, it is felt, is natural and beneficial. A certain number of our teachers at all events ought to be given, in addition to a purely practical training, a somewhat broader preparation for their profession. Training is given in the scientific technique underlying teaching, and an attempt is made to illuminate the technique by imparting some appreciation of the social and ethical issues bound up with the general problem of education.

So much for the aims and values which have governed teaching in the humanities and the social sciences. Something may be said, in conclusion, about the work of the departments in making original contributions to the various fields of learning referred to above. This kind of work, it may be remarked in passing, is carried on in the instructor's spare time after the teaching and routine work of the department have been attended to, and the extent to which it can be carried on depends on how heavy the teaching and routine work may happen to be. Its importance lies not only in the fact that the boundaries of knowledge are being extended but also in the fact—not perhaps so generally recognized—that the intellectual atmosphere occasioned by original work is the most effective agency to prevent teaching itself from degenerating into mechanical routine.

Original investigations

Original work in the humanities and the social sciences need not take the form (which it usually assumes in the physical and biological sciences) of definite and specific investigations. Not uncommonly it is a matter of re-inter-

preting and re-evaluating existing knowledge and of suggesting new lines of thought. While it is neither possible nor necessary, within the limits of this statement, to refer to all the publications in the humanities and social sciences in the University of Alberta, an indication may be given of the general nature of the contributions. In the field of English literature, critical and expository studies of various kinds have been produced. Mention may be made of *The Laureateship: A Study of the Office of Poet Laureate in England with Some Account of the Poets;* a book accepted as the standard work on the topic with which it deals. *The Story of English Literature*, recently published, is already widely known. *Anglo-Saxon Poetry* brings the remote literature of Anglo-Saxon England within the reach of the ordinary reader.

On the side of modern foreign languages, several lines of original work have been pursued. Books such as *The Old and the New Germany* and *Voltaire and The English Influence* represent contributions to the knowledge of political and literary history. Studies in French-Canadian literature have been published, and philological studies have been carried on in connection with the Romanic and Germanic languages. These latter studies, in their further development, may throw new light on the history of the peoples concerned. In the field of classical culture, the instructors have constantly endeavoured to keep in touch with the newest discoveries in archaeology, and their contributions in the fields of literature, history and text-criticism have found acceptance in the various standard journals of classical research.

In the social sciences, publications in the field of modern history have thrown new light on the relationships of the French and the British in the early days of colonization and on the first British experiments in colonial government in Canada. Two widely recognized contributions to economic science are *Cooperative Marketing in Western Canada* and *The Marketing of Canadian Wheat*. Original work in philosophical and psychological studies have been carried out in connection with the interpretation of Greek philosophic thought, the bearing of modern psychology on ethical theory, the experimental psychology of attention and of children's reaction times. In the school of education, among other publications, mention may be made of a recently published investigation of problem-solving in arithmetic.

"This process of training, by which the intellect, instead of being formed or sacrificed to some particular or accidental purpose, some specific trade or profession, or study or science, is disciplined for its own sake, for the perception of its own proper object, and for its own highest culture, is called Liberal Education; and though there is no one in whom it is carried as far as is conceivable, or whose intellect would be a pattern of what intellects should be made, yet there is scarcely any one but may gain an idea of what real training is, and at least look towards it, and make its true scope and result, not something else, his standard of excellence; and numbers there are who may submit themselves to it, and secure it to themselves in good measure. And to set forth the right standard, and to train according to it, and to help forward all students towards it according to their various capacities, this I conceive to be the business of a University."